



A.D. 1860, 14th MARCH. N° 675.

SPECIFICATION

OF

MICHAEL HENRY.

ARTIFICIAL HANDS, FEET, AND LIMBS.

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A.D. 1860, 14th MARCH. N° 675.

Artificial Hands, Feet, and Limbs.

LETTERS PATENT to Michael Henry, of 84, Fleet Street, in the City of London, Patent Agent, for the Invention of “IMPROVEMENTS IN THE CONSTRUCTION OF ARTIFICIAL HANDS, FEET, AND LIMBS, OR SUBSTITUTES FOR NATURAL HANDS, FEET, AND LIMBS, AND PARTS THEREOF.”—A communication from abroad by José Gallegos, of 33, Boulevard St. Martin, Paris, France.

Sealed the 24th August 1860, and dated the 14th March 1860.

PROVISIONAL SPECIFICATION left by the said Michael Henry at the Office of the Commissioners of Patents, with his Petition, on the 14th March 1860.

I, MICHAEL HENRY, of 84, Fleet Street, in the City of London, Patent
5 Agent, do hereby declare the nature of the said Invention for “IMPROVEMENTS
IN THE CONSTRUCTION OF ARTIFICIAL HANDS, FEET, AND LIMBS, OR SUBSTITUTES FOR
NATURAL HANDS, FEET, AND LIMBS, AND PARTS THEREOF,” communicated to me
from abroad by José Gallegos, of 33, Boulevard St. Martin, Paris, France, to
be as follows:—

10 This Invention relates to the construction of artificial members or substitutes
for the natural hand, foot, and limbs, and parts thereof.

In this Invention it is proposed to employ spiral springs as motive agents,
with which springs pulleys, cords, or pulls and points of attachment may be
combined. To explain the improvements, I proceed to describe them as applied
15 to a case where only a small portion of the natural member is remaining, as
they can evidently be more readily and simply adapted where more thereof
has been left, and a less considerable portion, as only the hand or fore-arm for
example, has to be supplied by artificial means.

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Artificial arm.—A cord is attached at one end to a lever connected to part of the artificial arm, and at the other end to a point on the remaining stump or sentient corporeal part, so that the wearer by a voluntary movement, may open or extend the arm, overcoming the resistance of a spiral spring which tends to close it towards the body; this cord regulates the degree of tension of 5 another cord, according to the position of a pulley over which it passes, and thus actuates the extension of the fingers, the pulley being adjustable by the other hand, with suitable arrangements for regulating the tenacity and vigour of the artificial hand; this may also be done by spiral springs, as herein-after described. The cord operates as a sort of check to regulate, slacken, or 10 moderate the arm's expansion. The artificial hand may be fitted to tubular pieces of leather or other suitable material, covering the stump where remaining, simulating the human arm, and together with the hand and mechanism composing the artificial limb. In the arrangement preferred, an armlet is fitted round the stump, serving as the first fulcrum of the action. The afore- 15 said lever is connected thereto. Axes or joints are provided for the play of wrist and elbow. The lever is fitted in the centre of articulation, and attached at the outer end to the tube representing the fore-arm. A sort of hook with toothed wheel may be used to regulate the tension of the regulating cord or cord that transmits action, and a strong spring is set in the centre of the 20 foregoing motion, operating independently or as auxiliary to the first-named spring. For obtaining a motion of the main part of the fore-arm in a rotary direction without interfering with the other mechanism two tubes are provided. Levers and single and double pulleys may be used for increasing, reducing, or regulating the power and time of travel of the limb for better imitating natural 25 action. The fingers are composed of artificial finger joints articulated progressively and independently, and working nearly at right angles on their centres, which may be of silvered steel, covered with silk cloth or other fabric for resisting oxydation and friction of the material composing the hand. Each articulation has a slot or notch lengthwise of the finger, with a pin across at the 30 part, in which is a recess in each slot serving as a stop and preventing jamming. The tendons consist of cords of sinewy filament, silk, steel wire, or other suitable material attached at their inner ends to points on the stump, whence impulsion may be transmitted to them; near the bottom of each finger is a spiral spring, which communicates action to the finger joints through the 35 tendons. The axis of each spring is mounted on plates fitted with a square for winding it up and regulating tenacity and vigour of grasp. The tendons that move in an opposite direction to the foregoing are actuated by the articulations and the mechanism of the tubes; the finger tendons may be worked

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together by a single cord attached to the armlet, by connecting them to a plate or appliance, the cord drawing them in the direction of a slot in which work studs or screws connected to the upper and outer part of the palm; a separate piece may be mounted on an axis or joint for actuating the little finger, somewhat in advance of the others, and the thumb operated by the pulley arrangement. The cord is connected to a pulley, round which passes a double cord, which rides also on a convex seat to accommodate itself to the varying positions of the wrist joint and palm. The end of the lever is concealed by a cap, and the fitting of the tubes is strengthened by and the elbow joint received in
10 straps or braces.

Artificial leg.—In the arrangement preferred of this limb, the skeleton or framework may be of a light and supple wood, strengthened at parts by metal plates or braces. The foot is articulated at the base by flexible leather joints or otherwise. A strong spiral spring works the ankle joint and supports the
15 weight of the wearer on the heel, so as not to distress the stump. A rounded piece is centred at the ankle joint for the longitudinal movement of the foot; another strong spiral spring in expanding produces the artificial knee-joint action, and hence the motion of the leg, assisted by the weight of the latter when lifted for walking. Through the centre of the spherical piece representing the knee joint passes a stationary axis, to which are connected rods or bars
20 constituting the calf and thigh, the end of a bar travels about one-fourth of a revolution in a slot, and rests at a stop, so as to come vertical when the wearer begins to walk. A perforated steadying bar is fitted lengthwise of the thigh for preventing too much oscillation of the lower part of the limb, its end is
25 covered with leather, and adjusted by inserting a moveable stud or pin into one of its perforations, and thereby regulating the limb's oscillation, this the person should try before wearing it. Braces or supports receive the knee-joint axis, and connect the bars of calf and thigh, which fold at right angles when the knee is bent. The stump is received in a socket lined with skin or other
30 comfortable material, and fitted with a screw for opening and closing it as desired. The artificial limb is retained in a forked holder, strapped round the waist, and with joints or hinges working vertically on horizontal axes and plates, whose lateral play is provided for by centering pins or pivots; slots, pins, and nuts adjust the part against which the upper hip bone bears, and a
35 buckling pad adapts the shape to the waist; the trouser is kept away from the main articulation by an elastic web, and the part of the limb near the knee joint is surrounded by a hoop or band.

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SPECIFICATION in pursuance of the conditions of the Letters Patent, filed by the said Michael Henry in the Great Seal Patent Office on the 14th September 1860.

TO ALL TO WHOM THESE PRESENTS SHALL COME, I, MICHAEL HENRY, of 84, Fleet Street, in the City of London, Patent Agent, send 5 greeting.

WHEREAS Her most Excellent Majesty Queen Victoria, by Her Letters Patent, bearing date the Fourteenth day of March, in the year of our Lord One thousand eight hundred and sixty, in the twenty-third year of Her reign, did, for Herself, Her heirs and successors, give and grant unto me, the 10 said Michael Henry, Her special licence that I, the said Michael Henry, my executors, administrators, and assigns, or such others as I, the said Michael Henry, my executors, administrators, and assigns, should at any time agree with, and no others, from time to time and at all times thereafter during the term therein expressed, should and lawfully might make, 15 use, exercise, and vend, within the United Kingdom of Great Britain and Ireland, the Channel Islands, and Isle of Man, an Invention for "IMPROVEMENTS IN THE CONSTRUCTION OF ARTIFICIAL HANDS, FEET, AND LIMBS, OR SUBSTITUTES FOR NATURAL HANDS, FEET, AND LIMBS, AND PARTS THEREOF," a communication from abroad by José Gallegos, of 33, Boulevard St. Martin, Paris, 20 France, upon the condition (amongst others) that I, the said Michael Henry, my executors or administrators, by an instrument in writing under my, or their, or one of their hands and seals, should particularly describe and ascertain the nature of the said Invention, and in what manner the same was to be performed, and cause the same to be filed in the Great Seal Patent 25 Office within six calendar months next and immediately after the date of the said Letters Patent.

NOW KNOW YE, that I, the said Michael Henry, do hereby declare the nature of the said Invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following 30 statement thereof, as communicated to me, reference being had to the accompanying Drawings, and to the letters and figures marked thereon, that is to say :—

This Invention relates to improvements in the construction of artificial hands, feet, and limbs, or substitutes for natural hands, feet, and limbs, and 35 parts thereof. By means of these improvements mechanical movements are obtained resembling the natural action of the human members; they are cheap in construction, and of so simple a description as to be easily obtained,

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and without being noticeable or conspicuous. An important part of this Invention rests upon the novel mode herein described of applying spiral springs combined or not with pulleys, cords, or pulls, and points of attachment.

In order to explain the improvements fully, I proceed to describe them as applied in cases in which almost the entire limb has to be supplied by artificial means, that is, where only a small portion of the natural limb is remaining, as it is clear that such arrangements can be all the more readily and simply adapted to cases where more of the natural limb is left, and consequently a less portion (as only the hand or fore-arm for example) has to be supplied by artificial means.

The accompanying Drawings explain the improvements and means employed for carrying them into effect.

Artificial arm.—Figure 1, Sheet I. is an elevation, and Figure 2, Sheet I., a plan of an artificial arm and hand constructed according to this Invention and arranged as follows:—*b, c*, is a cord attached at one end *b* to a lever or arm 11, and at the other end *c* to a fixed point or points on the remaining stump 12 near the part the latter springs from, or on the shoulder or sentient part of the wearer's body, so that the wearer may by a voluntary action on his part, open or extend his artificial arm, overcoming the resistance of a spiral spring 8, which tends to close it towards his body. The cord is shewn in the position it occupies when the arm is extended, and also in its position when the arm is bent. Another cord *x*, herein-after described, is also shewn in these two positions, that in interrupted lines indicating its position when the arm is bent, being nearly at right angles to that in continuous lines, which indicates it when the arm is extended. The positions thus exemplified shew that by having two fixed points of attachment *c* and *y* (one of which, as *y*, may be on the shoulder for example), the wearer can, by a drawing-back action at the point *c*, pull back the cord *b, c*, and thereby extend or open the arm as desired, and so regulate the degree of extension of the cord *x* according to the position of a pulley 14 over which it passes, and thereby effects the extension or opening of the fingers in proper order as herein-after described. The position of the pulley 14 may be varied or adjusted by the other hand by means of any ordinary arrangement, and particularly by that shewn in the Drawings, in order that the tenacity and power of the artificial hand may be regulated. This regulation may also be partially effected by means of spiral springs as herein-after described. 1 is an armlet or band fitted round the remaining stump 12, and serving as the first fulcrum of action; 3 is the artificial hand shewing its construction both closed and open. It is fitted to and held in place by tubular pieces 2, which I prefer to construct of leather, though other

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materials may be used, and which tubes 2 cover the remaining stump, and extend to the wrist, simulating the appearance of the human arm. The dotted lines 4 shew two positions of the stump for various sizes and shapes of arm, and exemplify some of the means adopted for replacing the principal motions of a natural limb. 5 is a spiral spring (one on each side of the wrist), these 5 springs may be graduated in power according to the strength required, or the functions the hand may have to perform; 5¹ shews the position of that spring 5 when the arm is bent against the body; 6, axis or joint for the play of the wrist; 7, two tubular pieces of leather whereby the turning action or motion in a rotary direction required at the fore-arm is obtained without interfering 10 with the other mechanism; 8, large spring in such position and of such power as to tend to bend the arm towards the body from the elbow joint; this spring 8 may be wound up by a key or otherwise, to regulate its expansion, and the cord x is wound on and tightened by it, but when the wearer, as before described, pulls the cord b, c , to extend the arm, the resistance of the 15 spring is overcome, and the cord x unwound or slackened; on the other hand, when the wearer ceases to pull the cord b, c , the spring 8 is allowed to act, and the cord x is tightened, the arm returning to its previous position; 9 is a sort of hook with toothed wheel 9^x, for regulating the tension of the cord x , the dotted lines shew the path the arm describes when worked from an 20 artificial elbow joint; 10, strong spring set in the heart of the motion before described, and placed in the direction with the elbow, it either operates independently or as auxiliary to spring 8; 11 is the lever (preferably of steel), centred in the elbow joint, and connected at one end to the tube of the fore-arm by a screw a , and at the other end b is an orifice b^1 , whereto is attached 25 the cord b, c , which is extended or slackened by the action of the stump 12 as described; 13, self-adjusting or sliding metallic cap piece, which conceals the end of the lever 11, and covers the elbow, accommodating itself to the play thereof; 14, single or double pulleys, which may be used with or without levers for increasing, reducing, or regulating the power of the fore-arm 30 and hand, and the time occupied by them in their motions for better imitating the action of a human limb; 16 are artificial finger joints (phalanges) articulated progressively and independently, and working nearly at right angles on their centres or axes, which are composed of silvered steel covered with cloth, silk, or other fabric whereby oxydation is prevented, and the friction of the wood 35 or other material composing the body of the hand is resisted; 17, 17, are the articulations of the joints 16, in each of which articulations is a slot or notch lengthwise of the finger, a pin extends across it at the part where there is a recess (in each slot) acting as a stop, and preventing the joints from

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catching or jamming at the upper parts at the points *d*; 18 are artificial tendons, consisting of cords or filaments of sinewy material, silk, steel wire, or other strong and durable flexible substance attached at their inner ends to points 15, 15, on the stump, whence impulsion may be transmitted to them; 5 19, are spiral springs at the base of each finger for actuating the joints through the tendons, the axis of each spring 19 is supported on a pair of plates 20; one of each pair having on it a square for winding the spring up and so regulating its power, and thence the tenacity and vigour of grasp; 21 are other tendons working in an opposite direction to the tendons 18, and actuated by 10 one or more cords or wires, worked by the articulations before described and the mechanism of the tubes. The finger tendons may be connected to a plate or piece 22, and worked together by a cord *f*, attached to the armlet 1, which draws them in the direction of a slot *g*, wherein work two screw studs fixed to the upper and outer part of the palm; but as it is not necessary 15 that all the fingers should move simultaneously, a separate piece may be mounted on the axis *h*, so that the cord *f* may move the little finger somewhat before the others; the thumb is operated by the pulley 14 arrangement. The cord *f* is connected to a pulley 24, round which passes a double cord 23, riding freely upon a convex seat so as to accommodate itself 20 to the varying positions of the wrist joint and palm without interfering with the action of any of the articulations; 25 are metal straps or braces for strengthening the adjustment of the tubes and for receiving the elbow joint. The principle of the foregoing system of construction may be said to consist in the subdivision of the mechanism. The use of spiral springs as agents of 25 impulsion is advantageous on account of their strength, sustained tenacity, and expansive elasticity of action, and also on account of their being graduated or regulated at pleasure; their power is very considerable in proportion to their weight and size.

Artificial leg.—The same principles of construction are applied to the manu- 30 facture of artificial legs.

Figure 1, Sheet 2, is a view of the improved leg, shown both bent and straight. Figure 2, Sheet 2, represent details. The skeleton may be constructed of light and supple wood, strengthened at parts by metal plates or stays fastened on by screws. 1 is the artificial foot jointed at the base at *a* 35 and *b* by flexible leather joints 2, which may be here used instead of metal or other hinges; 3 shows the paths of these joints; 4 is the ankle joint; 5, a strong spring working the ankle joint 4, and supporting the weight of the wearer on the heel so as not to distress the stump; 6, rounded piece turning on the axis or centre 4 for the longitudinal motion of the foot; 7, four metal

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bars, connected at intervals by curved metal stays *c*, and representing the leg ; 8 is a strong spiral spring, which in its expansion produces the artificial knee-joint action, and thence the motion of the leg, which is assisted by the weight of the latter when lifted for walking ; 9, spherical piece, representing the ball and socket knee-joint action ; through the centre of this piece is fixed an axis 5 or pin, to which are connected the bars 7, and also the bars extending along the artificial thigh. The end of a bar (of wood or other solid substance) travels about a quarter of a revolution in a slot 10, and rests at *g*, so as to come straight or vertical when the wearer is beginning to walk ; 11 is a strong perforated wood bar, which I call a steadying bar, and which extends length- 10 wise along the artificial thigh ; it is intended to prevent the lower part of the limb from swinging or oscillating unnecessarily, and is adjusted by inserting a screw bolt *s* in one of its perforations *j*, Figure 2, so as to regulate the degree of oscillation to suit the wearer, according to the hole in which the bolt is inserted ; and this he should try before regularly wearing the limb ; 12, metal 15 supports for receiving the axis of the knee joint, and connecting the bars 7 of the leg and the bars of the thigh ; these supports fold at right angles when the knee is bent ; 13, top fittings of the limb, consisting of a socket or rest, which receives the stump, and is lined or padded with leather or other comfortable material for the purpose ; it may be opened or closed more or less, as 20 desired, by a screw 14, so as to hold the stump more or less tightly within it (22 is the opening between the edges, across which the screw 14 passes) ; 15 is a forked holder for supporting the artificial limb, and which is fastened round the wearer's waist by straps *k* and buckles, and it has joints or hinges 16 working at right angles to their horizontal axes, and also plates *l*, the 25 lateral play whereof is provided for by pins or pivots 17, on which they work ; 18, slot, screw, and slide nut, for adjusting the length of the part against which the upper hip bone rests ; 19, pad, which buckles on to adapt the shape to the waist ; 20, elastic web, for keeping the trowser away from the main articulation. Round the upper part of the limb near the knee joint is fitted a metal 30 hoop, plate, or band 21. Thus, as in the instance of the artificial arm, where motion is principally communicated by the other arm or the stump remaining by means of a pulley and cord, so also the same advantages are obtained by the wearer's availing himself of the impulsive action of his leg, himself selecting the part or parts to which he finds it most convenient to attach the 35 opposite ends of the cords that pass over intervening pulleys, and which cords may be of catgut or of flexible material so contrived that one may be more elastic than another, and corresponding to the pulleys, whether the latter are single, double, or compound, these being so combined as to increase or reduce

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the power and rapidity of action of the principal artificial movements ; a ball-and-socket joint may be used at the wrist, whereby the auxiliary motions required at that part are more easily obtained.

And having now described the nature of the said Invention, and the manner
5 in which the same may be performed, I declare that the said Invention relates to the manufacture of artificial hands, feet, and limbs, that is to say, of substitutes for the natural hands, feet, and limbs, and for parts of them, and that what I claim is,—

First, the application or employment of spiral springs in the manner herein-
10 before described.

Second, the arrangements of artificial hands, feet, and limbs herein-before described.

In witness whereof, I, the said Michael Henry, have hereunto set my
hand and seal, this Thirteenth day of September, One thousand eight
15 hundred and sixty.

M. HENRY. (L.S.)

Witness,

S. E. A. NEWSOME,

Patent Office,

20 84, Fleet St., London.

LONDON:

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Printers to the Queen's most Excellent Majesty. 1860.

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FIG. 2.

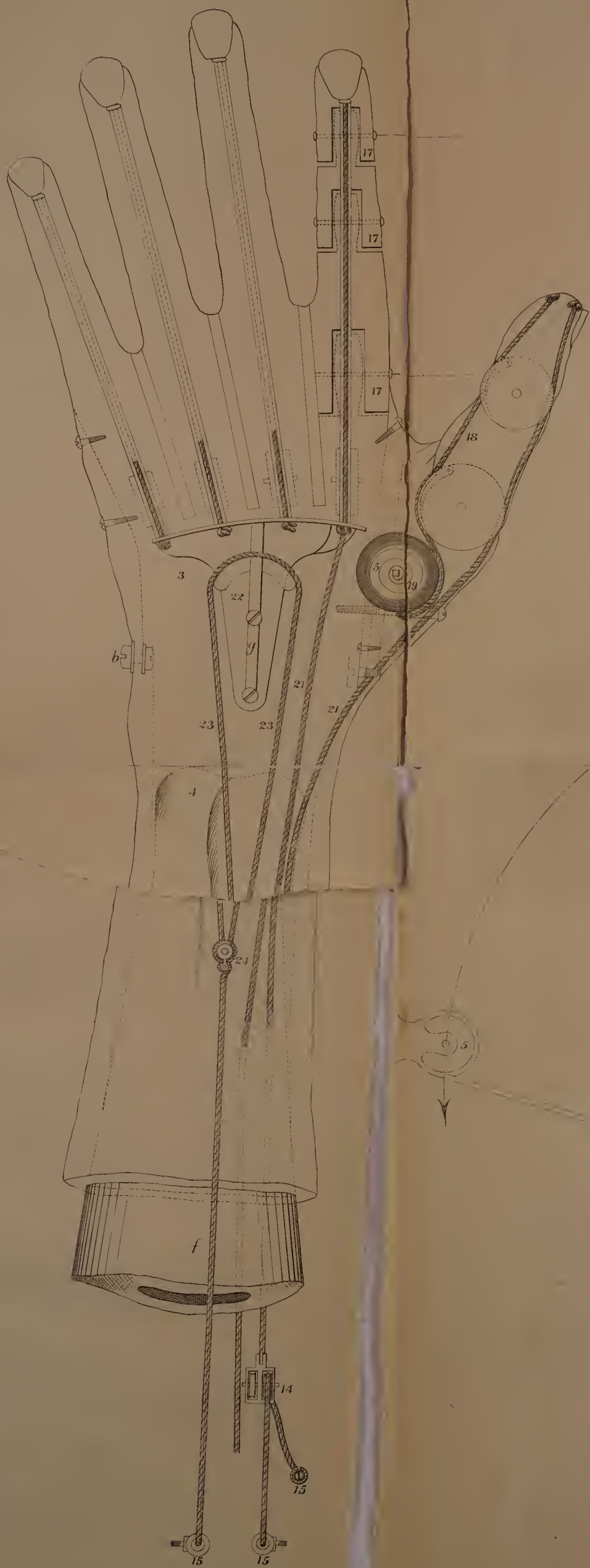
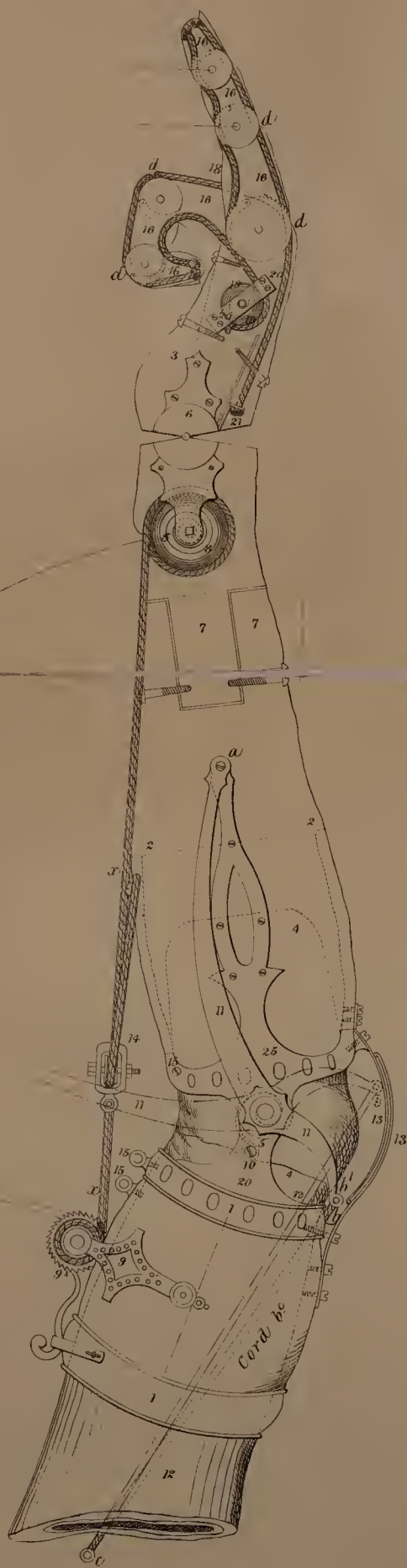


FIG. 1.



The filed drawing is not colored.

Drawn on Stone by Malby & Sons

FIG. 1.

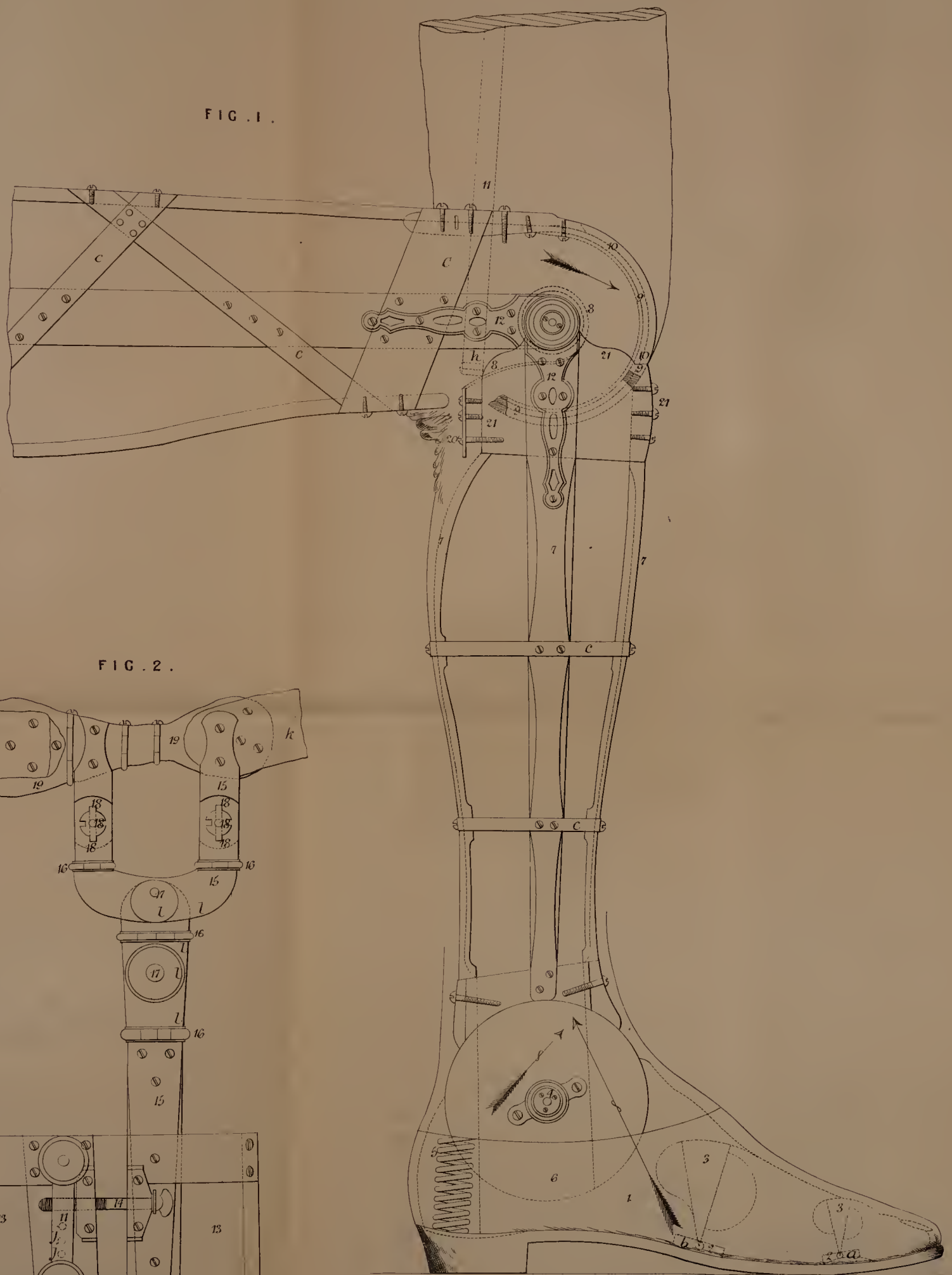


FIG. 2.

